Learner challenges and situated learning: Engaging students at Sydney Olympic Park

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In this paper, a new approach to school excursions is described in the development of a School Excursion Education Program at Sydney Olympic Park. Best known as the location of the Olympic Games in 2000, the Park has a wealth of opportunities for the examination of a range of issues other than sport, such as natural environments, endangered species, pollution and toxic waste disposal, Aboriginal significance, sustainable housing, and design and technology in the built environment. This paper describes the design and development to date of an excursion program for schools based on constructivist philosophy, situated learning theory and the use of technology to create a meaningful and effective learning environment for the sustained examination of significant issues. Essentially, the paper is a case study of how place and technology can be connected within a specific learning context, and how onsite technology ‘pods’ and other web engagements are designed to support complex learner challenges.

Keywords: situated learning, problem based learning, excursion

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Introduction

The increasing growth in the use of information communication technologies in recent years is changing the ways in which educational institutions are approaching their core business of teaching and learning. Both nationally and internationally such organisations are investigating ways in which the technology can be used to provide a range of learning opportunities for students of all ages. This paper outlines one such application of the technology in the development of a series of online ‘learner challenges’ at Sydney Olympic Park that are based on a constructivist approach, specifically using characteristics of a situated learning model (e.g., Savery & Duffy, 1995; Herrington & Oliver, 2000).

The Parklands at Sydney Olympic Park, while probably best known in recent times as the location of the Olympic Games in 2000, has a rich and diverse history. The site covers over 400 hectares and consist of a unique mix of natural and made environments including: pristine woodlands, salt marshes and mangroves that play host to a diversity of flora and fauna in close proximity to reclaimed industrial sites, a modern sorting complex and housing and industrial estates. The Parklands are also a place of Aboriginal significance and historic importance. The Sydney Olympic Park Authority (SOPA) is responsible for promoting the historic, scientific, cultural, and educational value of the Parklands. In promoting the educational value of the Parklands, SOPA has embarked upon the development of an innovative School Excursion Education Project (SEEP) creating a unique and imaginative program that has the potential to set new standards in the use of information and communication technologies in learning. The Project implements the vision of Parklands 2020 through a partnership between SOPA, the New South Wales (NSW) Department of Education and Training, the Sydney metropolitan Catholic Education Offices, the University of Wollongong, and Sun Microsystems. Through this partnership, the program aims to create a range of educational experiences that embrace technology supported learning and teaching. It is proposed that the program will continue to evolve and develop new approaches through applied research on education, technology and Sydney Olympic Park.

A new approach to school excursions

In the past, school visits to the Sydney Olympic Park have followed a conventional excursion model. Teachers wishing to take students to the park would have a choice of pre-determined excursion themes, from which they would choose one, and information on the activities and venue would be forwarded to the school. Variations to the excursion activities could be negotiated to suit individual school requirements. Arrangements would be made to transport students to the park, and the students would generally have minimal preparation for the tasks that were to perform while at the park, and little follow up later on their understanding of the events that occurred during the day.

The new excursion program adopts a more radical approach, underpinned by recent learning theory and research. It actively draws on principles of situated and authentic learning to embed investigation of the natural and built environment at the park into realistic problem solving tasks that specifically address curriculum outcomes. Rather than see the excursion as a one off, isolated event, the new approach is to situate the on site events within the context of a comprehensive pre- and post-visit program. It establishes links between classroom based and non-classroom based learning and information and communications technologies. All subject areas can exploit the uniqueness of the Parklands across years K-12.

Throughout the site, computer terminals are being installed at a range of locations (named *pods*) that focus on specific features of the overall site. Students, with computer access through an individually issued smart card, are able to integrate direct observation and experience in this unique physical world with resources held electronically in responding to their learning challenge. This combination of place and technology provides the potential for Sydney Olympic Park to become an important cross curriculum learning resource, allowing users of all ages to experience unique environments supported by technologies with recent learning theory driving the design of the learning experiences.

A generic problem solving approach is used to focus students' efforts on complex problems that will take several weeks to complete. Students participating in the excursion program will explore and interrogate targeted databases of learning activities that will support a range of syllabus requirements. In groups, the students will work on a single complex and sustained challenge through related activities in the class, at home, and through a critically timed visit to Sydney Olympic Park. They will engage in work on the web, in class, in the field and in technology pods with an emphasis on student centred, task driven activities that will require them to explore data and information, construct and test hypotheses where appropriate, and present conclusions and solutions in the form of a range of artefacts.

Teacher support is also an important part of the program. Teachers will be able to source innovative learning material and use technology to construct learning experiences relevant to syllabus requirements. They will have the flexibility to construct lessons to meet individual student needs, while having the necessary support to meet the demands of developing learning experiences for many students. They will be supported through professional development programs and educational resources.

Learner challenges and tasks

The concept of a *learner challenge* has been developed to present a single complex and sustained task for each excursion. The task takes the form of a realistic problem that could not be completed within the timeframe typically given to excursion activities. Pre- and post-excursion tasks are necessary to prepare for the excursion and to follow up with the creation of an artefact or product. The characteristics of a learner challenge could be thought of as a large scale activity, while contributing activities could be thought of as the tasks that learners engage in to meet the challenge. The learner challenges are being designed to:

- be problem based;
- connect to the real world beyond the classroom;
- represent an educational outcome and substantive intellectual activity of educational value which can be demonstrated;
- incorporate the production of learner artefacts which require demonstration of a variety of communication skills;
- link to NSW syllabus outcomes;
- engage knowledge and skills from multiple knowledge domains;
- enable flexibility for schools to address local contexts;
- require analysis that goes beyond merely reporting content;
- involve topics of interest to learners of the age group targeted; and
- require concerted learner effort over a period of 5-8 weeks and can be thought of as a Unit of Work or Study in terms of learner effort. (NSW Dept. of Education and Training, 1998)

The learner challenges are being developed within this framework. A challenge is set, learners are scaffolded using the project web site that will incorporate an educational performance support system to explore their challenge and develop a research plan as well as a rich set of resources, structured through a digital repository (Wiley, 2002). This process is being explored as a key component of the project (c.f., Cotton, Lockyer, Brickell & Harper, 2004). A conceptual representation of the phases of the process mapped against the location of the task is given below in Figure 1.

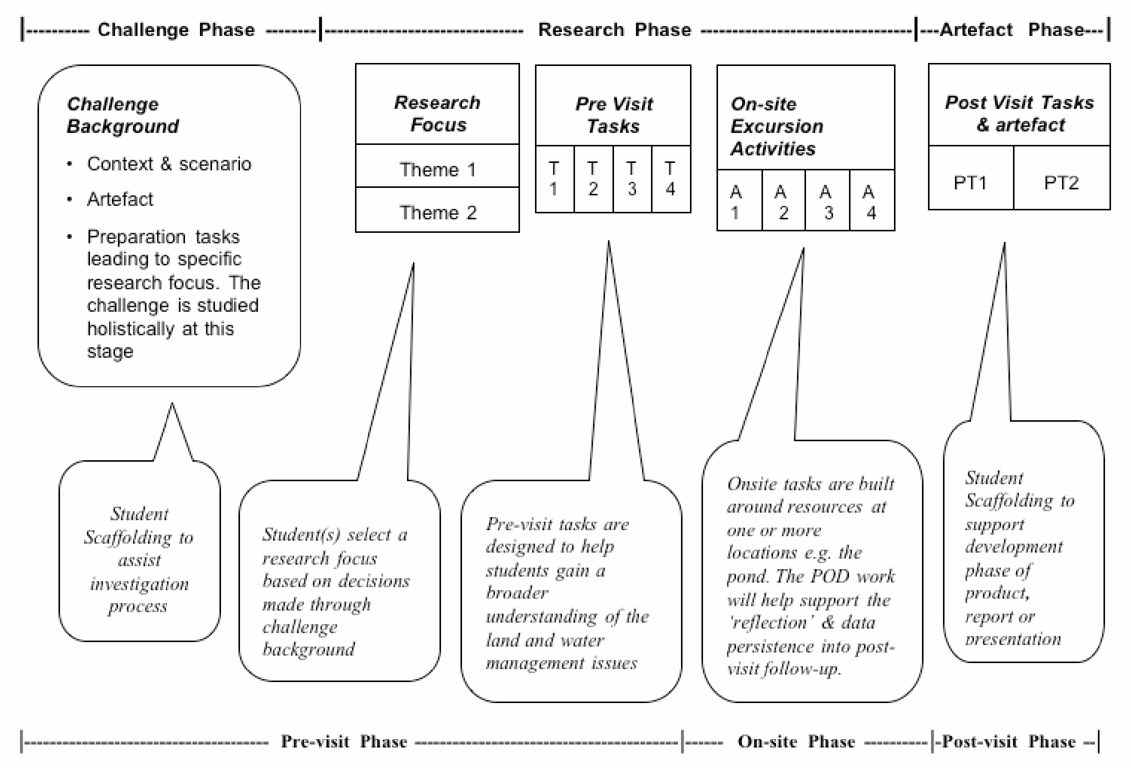

Figure 1: Process and time phases of the School Excursion Education Project (SEEP)

Theoretical foundations of the approach

The new excursion program has been designed within a constructivist philosophy, drawing more specifically on situated learning theory. Over the last decade the rapid interest and development in the use of digital technologies for teaching and learning, both nationally and internationally, have stemmed from an associated link with a body of literature that promotes a general constructivist/ social constructivist model of learning. This philosophical view sees learning as an active and interpretive process of making meaning rather than the memorisation of facts (Oliver, 1999). Savery and Duffy (1995, p. 31), in adopting this approach, have suggested the following design principles for constructivist learning environments:

- anchor all learning activities to a larger task or problem;
- support the learner in developing ownership for the overall problem or task;
- design and authentic task;
- design the task and the learning environment to reflect the complexity of the environment they should be able to function in at the end of the learning;
- design the learning environment to support and challenge the learner's thinking;
- encourage testing ideas against alternative views and alternative contexts;
- provide opportunities for and support reflection on both the content learned and the learning process.

More specifically, the theory of situation cognition asserts that what we come to know and understand is fundamentally a product of the learning situation and the nature of the learning activity. Learning tasks should, as far as possible, be embedded in the target context and require the kind of thinking that would be done in real life (Lave & Wenger, 1991; Brown, Collins & Duguid, 1989). Situated cognition emphasises higher order thinking skills and has grown out of research that explored the way that people reason and solve problems in everyday life. Choi and Hannafin (1995) further support this view, suggesting that ‘Situated cognition emphasises the importance of context in establishing meaningful linkages with learner experience and in promoting connections among knowledge, skill and experience’ (p. 54). Elements of situated learning have been identified from the extensive literature on the subject, such as: authentic context, authentic activity, expert performance, multiple perspectives, opportunities to reflect, collaborate and articulate, coaching and scaffolding and authentic assessment (cf., Herrington & Oliver, 2000). Technology supported problem solving embodies many of the elements of situated cognition through emphasis on solving authentic problems in authentic contexts that enhance the development of higher order thinking skills.

In keeping with this approach, a complex and realistic task is the central focus of both the excursion and other pre- and post-excursion activities. A generic problem solving approach - based on models proposed by Bransford and Stein (1992) and Jonassen (1997) - is used to focus students’ efforts on the challenge and the development of a possible solution(s). Figure 2 below shows general stages in the problem solving process and how it relates to the excursion timeline.

	Problem-solving stage	Excursion stage
1:	Identify the purpose of the investigation	**Pre-visit tasks**
2:	Generate focus questions	
3:	Deciding which primary and secondary data are required	
4:	Identify the techniques that will be used to collect the data	
5:	Collect primary and secondary data	**On-site activities**
6:	Process and analyse the data collected	**Post-visit tasks**
7:	Select presentation methods to communicate the research findings	
8:	Propose individual or group action in response to the research findings	

Figure 2: Problem solving stages attempted at each stage of the excursion

The design guidelines and technologies used are customised for different purposes in each stage, as described below.

Pre-excursion tasks

Situated learning theory guides the entire excursion program, and it is strongly evident in the pre-excursion activities. Each excursion is guided by a learner challenge, a complex and realistic task with no simple solution. It sets the parameters for the scope of the investigation, without specifying step by step how the challenge should be resolved. It also provides brief information on the artefact or product that the students will prepare, and the context and nature of the presentation of their findings. Students are presented with details of the problem within an authentic context, such as in the geography challenge example given below (Figure 3).

Students have the opportunity to investigate a range of online tasks prior to their on site excursion to the Park. These tasks support the first steps in a research action plan, such as: exploring the scope of the problem, generating research questions, deciding on the data that will be required to answer the questions, and identifying data collection strategies. In completing these tasks, students have access to a variety of resources that present diverse viewpoints and interests, as well as expert opinion and comment. The students work collaboratively in groups with support from both their own teacher and with in-built scaffolding and prompts on the website. The processes that students typically utilise in this stage are brainstorming, problem definition and general background research, together with decision making on the data that are required and how they will be collected.

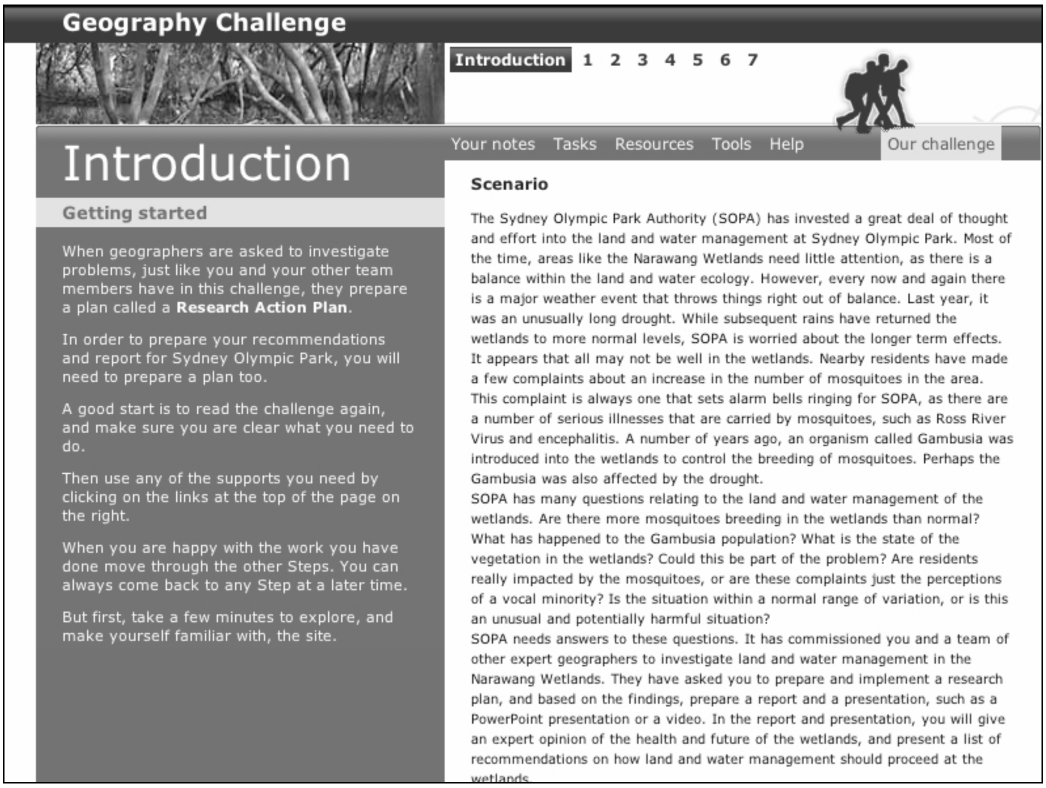

Figure 3: The learner challenge, presented as a realistic and authentic activity

Technology and tools that are appropriate for this stage include access to the Sydney Olympic Park excursion website (documents, photographs, maps, video and audio resources, and GIS mapping technology), brainstorming tools such as concept map software/templates, and research tools such as web browsers and library resources. Products from this pre-visit stage include the definition of the problem and research parameters, and the required data.

On site activities

In the critical on site visit to the Sydney Olympic Park, data is collected, through student engagement in a range of excursion activities, and stored in a retrievable form. Students rotate between data collection onsite and data inputting activities in the computer terminals in the pods. In this phase, additional theoretical principles apply that draw from literature and research on field trips, nature trails and excursions (e.g., Landis, 1996; van Trommel, 1990; Trust, 1991) and from theory relevant to learning from museums—informal or free choice learning (Falk, 2004; Anderson & Lucas, 1997). Emphasis in this stage is on effective preparation through the use of advance organisers, efficient data collection strategies and effective use of tools and technology in the pods for data entry and initial analysis.

Tools used for data collection include navigation aids such as maps and compasses, observation and measurement tools such as magnifying glasses, measuring tapes and thermometers, and recording tools such as data sheets, video and digital cameras. The activities at the site are designed for learners to explore their challenge further in the site setting, collect data in the field and analysing that data at the Pods located at the site. The pods consist of small technology labs on the Sydney Olympic Park site making use of Sun Microsystems SunRay technology. In the pods, information is location specific and easy to read, as time is limited and data must be entered quickly and efficiently. Students are able to enter their own data and compare their findings to other groups on the same day, as well as to historical data (see Figure 4 for an example of the data entry interface in the pod). Learners enter data, in this case in the form of counts of mosquito larvae and wrigglers. They then explore and analyse the data and reflect on their understanding of their data in relation to the learner challenge. In this analysis, they are given two levels of scaffolding which they can choose to use. At the first level, students are given a space to explore their understanding of their data (and how it relates to the data of other groups at the park and to historical data) under three broad headings: *Analysis/comment, Theme focus, and Summary*. At the next level, questions are provided to prompt their thinking, such as: ‘One solution for reducing mosquitos in the Narawang Wetlands is to use chemical sprays. How do you think different interest groups would see this approach?’ If they so choose, students can access further prompt questions such as ‘How do you think local residents would react? Do you think they would be pleased that something was being done or do you think they might object to spraying potentially dangerous chemicals near their homes and schools? What about regular visitors to the park? What about ecologists and environmentalists?’

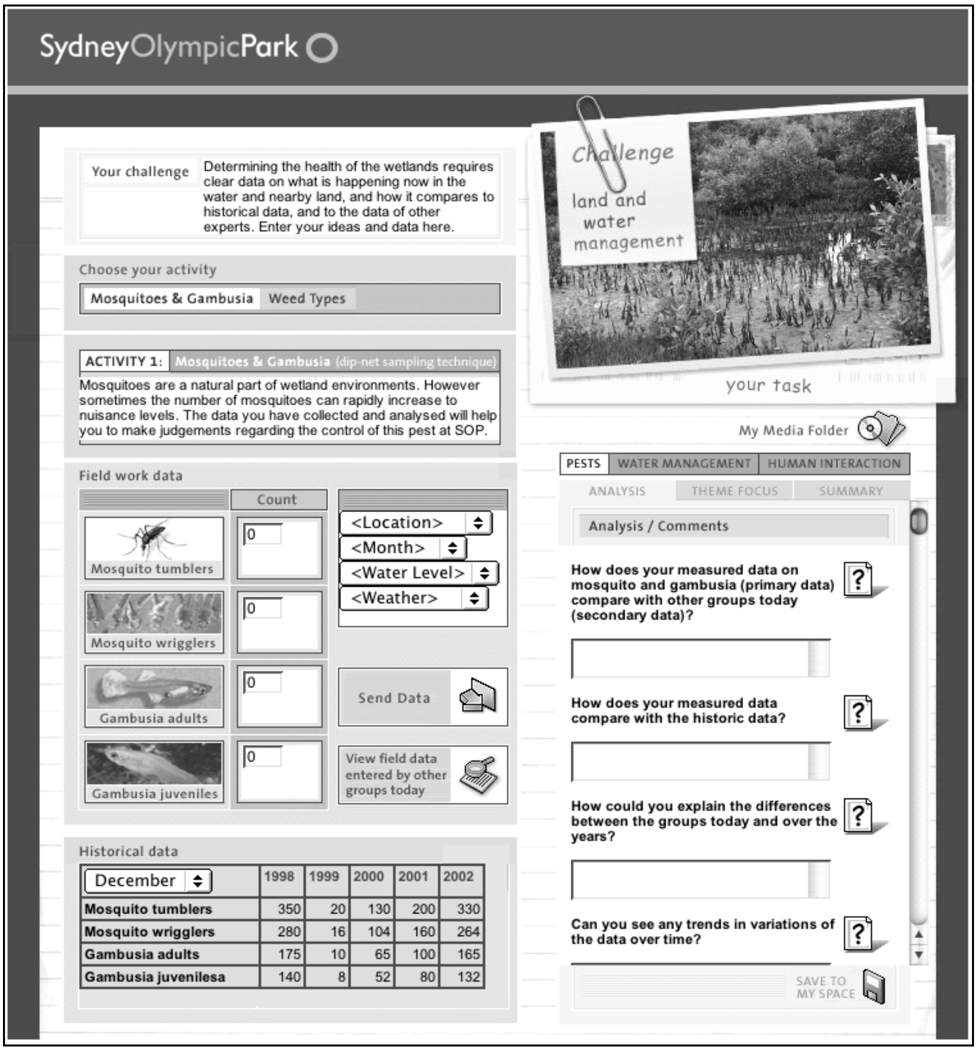

Figure 4: The data entry and analysis interface in a technology pod at the Sydney Olympic Park site

The product from this stage is data in a form that is retrievable from the Sydney Olympic Park website from the home school location. The data entered at the technology pods is saved to a server, and is then available to students on return to school to continue with the completion of their research plan and report.

Post-excursion tasks

Post-excursion tasks complete the research action plan by guiding students to analyse their data, draw conclusions and make recommendations. In these stages, students work towards the creation of a polished product, such as a report, a video or a presentation, to present their findings and recommendations. Tools used in this stage include research analysis tools such as spreadsheets, word processors, and calculators, and presentation tools such as Powerpoint, web authoring tools and video editing software. The product of the final stage is the culmination of the entire challenge.

Each of the stages, together with guiding principles, tasks, tools, resources and outcomes is summarised below in Table 1.

Table 1: Summary of design principles, processes and products of SEEP

	Pre-excursion	On site	Post-excursion
Theory	Authentic/situated learning/constructivist	Excursion/field trip Kiosk/display/museum	Authentic/situated learning/constructivist
Principles	• Authentic context • Authentic task • Multiple perspectives • Expert performance • Collaboration • Reflection • Articulation • Scaffolding and coaching • Authentic assessment	• Advance organisers • Information chunking • Appealing display • Collaboration • Immersion/ hands on • Reflection	• Authentic context • Authentic task • Multiple perspectives • Expert performance • Collaboration • Reflection • Articulation • Scaffolding and coaching • Authentic assessment
Tasks	Brainstorming/problem definition Background research Data collection decisions GIS mapping	Collecting data (facts, figures, measurements, images, etc) Storing data in retrievable form GIS mapping	Conducting further in depth research Using data to solve problems Creating products/ presentations
Tools	Brainstorming tools: • Inspiration • Concept map template • Word processor Research tools: • Web browser • Acrobat	Data collection tools: Navigation tools: • Maps of park Communication tools: • Walkie talkie • Mobile phone/textmessage Observation tools: • Binoculars • Magnifying glass Measurement tools: • Stopwatch (duration) • Measuring tape (distance) • Scales (mass) • Thermometer (temperature) • Calculator Recording tools: • Digital video camera (moving pictures) • Digital still camera (images) • Cassette recorder (sounds) • Clock (time)	Research tools: • Web browser • Templates Analysis tools: • Word processor (Word) • Spreadsheet • Database • Calculator Presentation tools: • Presentation tool (Powerpoint) • Word processor (Word) • Spreadsheet (Excel) • Web page software (Home page, Dreamweaver) • Drawing/painting package • Video editing software (iMovie) • Photo manipulation/ publishing (iPhoto, Photoshop)
Content/ resources	*SOPA website* Documents: • Original documents, Pdfs • Transcripts of interviews Video: • Video vignettes • Interviews • Quicktime VR panoramas Audio: • Interviews • Sounds (eg birds) Visuals: • Photographs, maps	*Kiosks/computers in onsite pods* Location specific information (ie. not a lot of detailed info, more about finding what and where) • Easy to read instructions, big typeface, chunks of information • Video excerpts • Maps and directions	*SOPA website* (same as Pre-excursion) Allows more in depth reflective research
Product	Definition of problem and research parameters Definition of required data	Data in retrievable form	Problem solution Polished product presentation

Evaluation

While the project has not yet been fully implemented, evaluation has been a critical component of each stage of development, as recommended by Reeves and Hedberg (2003). A review of excursion programs at Sydney Olympic Park, together with a literature review and a search for alternative existing resources, informed the project conceptualisation. A needs assessment determined that a more integrated and wholistic approach to the school excursion was required, and this evaluation stage informed the design brief for the project tender. Formative evaluation has been conducted at many stages and at different levels throughout development of the program to date. Once the learning challenge was developed on paper (alpha version), and again in prototype form, it was ‘expert’ reviewed by representatives from the Department of Education and Training (DET), the Catholic Education Office (CEO), and Sydney Olympic Park. User testing and observation has also been conducted, on initial and beta forms of the resource both on site and in schools, with classes of students from the target groups (Years 9-11). Debugging and navigation testing is an ongoing activity. These evaluation processes conducted to date, have informed the development stages of the process. When the project is fully implemented, further effectiveness evaluation will be conducted, and later impact evaluations will also provide critical information on long term effects of the excursion program.

Conclusion

Recent curriculum documents in Australia on the use of digital technologies emphasise the development of advanced thinking skills through student centred approaches for learning. Such skills are promoted through the use of investigation, reflection, analysis, synthesis and evaluation to generate or refine knowledge. The learning activities and interactions designed for this project are being constructed within the framework of the NSW school curriculum and the educational philosophy and pedagogical description of the educational setting at Sydney Olympic Park. Situated cognition, as a general theory of knowledge acquisition, has particular relevance to this development where the ‘learning challenges’ are presented as a function of the activity, context and culture in which they occur.

This project has the potential to model best practice in use of digital technologies in supporting this development through student engagement in rich tasks or learner challenges—tasks that are long term, ill structured and require learners to investigate solutions to problems in a planned way so as to go beyond the ‘comfort zone’ of established routines and familiar backgrounds.

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